Visualite

COLOR MANUAL

SOCONY PAINT PRODUCTS

Visualite

COLOR MANUAL

SOCONY PAINT PRODUCTS
DIVISION OF SOCONY-VACUUM OIL COMPANY INCORPORATED
NEW YORK N Y CHICAGO ILLINOIS

SOCONY PAINT PRODUCTS COMPANY
BEAUMONT TEXAS LOS ANGELES CALIFORNIA

Printed in U. S. A.

VISUALITE COLOR MANUAL

OUTLINE AND INDEX

KNOW YOUR COLORS—Continued

FOREWORD

There is a strong trend toward a greatly increased use of color in many phases of our lives. This is evident in our homes, offices, manufacturing plants, and the furnishings and equipment which they contain. Certainly we in the paint industry have a particular interest in color, since it is an important function in the use of paint.

While we are all conscious of color, most of us have only a sketchy knowledge of how to use it to the best advantage. Color, like many other things, must be used with discretion if desirable results are to be obtained; it becomes necessary to know — where, why and how to use colors to satisfy a specific need.

In order that our organization might perform the greatest service in intelligently applying color to Industrial uses, we have found it necessary to provide authoritative information on this important but little understood adjunct to our business. We are happy to have had the able help of Muller-Barringer, New York color specialists, in preparation of the text, illustrations, and typographical layout with the editorial collaboration of our organization, for this Visualite Color Manual.

It is not casual reading, but we believe it sufficiently interesting and informative to warrant a careful study.

SOCONY PAINT PRODUCTS

INTRODUCTION

TREND IN SALESMANSHIP

The trend in the sale of paint, as in the sale of other products for industry, is more and more toward the rendering of an expert service along with the supply of the material.

Today the most competent salesman is the one who is best informed as to his product, who not only knows it from the ground up technically, but also the various functions it will perform for industry. Today similarly the most saleable product is the one that has been designed not only to meet physical and chemical standards but to accomplish certain definite results for industry. Visualite will produce definitely desirable results for industry. Visualite is more than an assortment of paints; it is our name for a *paint plan*. It is a plan which uses a group of properly selected colors for the specific purposes of industry. It is a plan that aims to accomplish savings and increase profits for industry through its adaptability in aiding all forms of visual tasks.

COLOR – A SALES COMMODITY

Sales techniques have changed because the industrial buyer of paint is a wiser buyer. He has had the opportunity of making comparisons, he has seen publications and brochures on the subject and he knows what results he is seeking. To best serve this type of buyer we must

provide the answers to the questions and also supply the stimulation of the imagination of the prospect so he can visualize the final effectiveness of the Visualite plan. In addition to knowing the technical aspects of paint and its application, we must be well versed in the fundamentals of color and illumination.

VISUALITE

VISUALITE—A PAINT PLAN

In purchasing paint, the buyer thinks in terms of his own industry. He automatically asks himself, "What will Visualite do for my plant?" His interest is not solely the covering of certain surfaces with paint. He will want to know why and how the Visualite plan will help the production schedule of his plant.

It will be necessary to establish the values accruing from the use of the Visualite plan, taking into account both the tangible and intangible factors; increased production, lowering of accident rate, decrease in absenteeism brought about through a harmonious color arrangement, improved illumination without increase of power input and the whole engineered to provide an atmosphere which will be adequate for performing visual tasks.

Visualite is flexible and will cover special problems which will be encountered in some plants. Before setting up a set of recommendations it will be necessary to survey and arrive at an intelligent appraisal of the problems encountered.

VISUALITE COLOR GROUP

The Visualite basic group of colors has been developed as a simple but universally workable assortment for industrial "paint planning".

RANGE

The colors approximate the range now popular and cover adequately the light reflection range required. The assortment provides a simplified coverage of the spectrum and offers a balanced selection of vivid and subdued colors to provide the necessary flexibility in forming many varied color schemes.

COMPATABILITY

Each and every color in the group has been tuned to the others by comparisons for harmony or contrast which is a required relation in any good color scheme. This also insures against bad combinations under conditions that may force variations on the recommended color harmonies.

COLOR IDENTIFICATION

Everyone has the tendency to identify colors with words or names of objects familiar to them. Colors in the general market have often been successful more because of the implications of their color "name" than because of their other color characteristics.

The normal emotional reaction to color is intangible and elusive, but a name can help confine color reaction to definite associations and appeal. Good identifying names have been selected by using words from the language of industry and the man's world.

One cannot be too careful of the descriptive words used in speaking of color because they so often imply a specific use of that color which may condemn it for the purpose at hand; "A light grayish tan" the color of "weathered pine boards" is a good wall color for offices and a pleasant neutral utility color for corridors. The same color described equally accurately as "a faded khaki" is depreciated in these terms and sounds less attractive. The same color described even more accurately as "beige" is immediately dissociated from industrial or business usage. "Beige" will have the most definite meaning to anyone with experience in the field of color, but the layman may consider it an obscure and fancy foreign term. Or, at most, the layman will associate "beige" with women's stockings or home decoration of the "chi-chi" variety. Similarly, if there were occasion to use a pale warm tint of red or a very light neutralized shade of orange it would be well to avoid any mention of its resemblance to "old rose". To speak of a bluish grey with a touch of red in it, as "mauve" would be fatal.

KNOW YOUR COLORS

WHAT'S IN A NAME

If you are to use color well you must know each as an identity and know what its role can be in a team formed to do a specific job. The color name, although a formal introduction, reveals something of the family group. The reflectivity value which is the percentage of light reflected is given with each color. This is just as important to illumination in a plan as the weight of an individual is to the take-off of an airplane.

COLOR RANGE

Each color has a relative location in the spectrum which is academically called its "hue". Many systems arranged on cones, spheres, triangles or other diagrams have been devised to specifically locate a hue in relation to its fellows. The most scientific specification of color would be to name its light wave length in millimicrons, as 585 for a certain yellow orange, but there the language of science would only tend to confuse the issue. It is interesting to note, however, that the millimicron notation is useless to the practical colorist as it gives no clue to gradations as the eye sees them. For instance, in 40 points between 510 and 550, the eye encounters an apparently uniform green whereas in only 10 points between 580 and 590 it can discern seven yellow oranges.

This is mentioned because there has been a strong tendency to try to couple the visual reactions with scientific or diagrammatic systems.

COLOR AS SENSATION — "PRIMARIES"

Another instance of conflict between the facts of physics and chemistry and the facts of visual and human behaviour lies in the consideration of primary colors. All of us at some time have been taught that red, yellow, and blue are the primary colors — that white is not a color but simply the presence of light and that black similarly is just the absence of light. This is true

from the standpoint of color mixing but tests have shown that the values differ when we are concerned with human reactions.

Ostwald, dealing with the physics of color, splits the spectrum into four *primary* parts — red, yellow, green and blue. He refers to the light spectrum, where color is at its purest, and not to the "impure" color with which we work in pigments.

Thus we find one expert stressing three fundamental colors if he is dealing with the chemistry of paint; another expert naming four primaries if he is theorizing on pure colored light, and other experts presenting seven unique colors as basic to the understanding of color psychology.

From the human behaviour point of view, a color is "*primary*" if it is outstanding and individual in the sense that it is not to be confused with other colors.

On this basis, both black and white are colors for they are as obvious and as tangible to the layman as red, yellow or blue. Green is also considered "primary" because it stands distinct from yellow or blue and has as individual an effect as any.

Contrariwise tests have shown that orange does not give rise to reactions that differ from red or yellow, so it should not be considered as "primary". It was found that a great majority of people observed a middle orange as either a "hot yellow" or a "yellowish red" whereas

none ever referred to a green as a "bluish yellow" or "yellowed blue". It is interesting to note that usage is gradually eliminating orange from the safety code, perhaps for this psychological reason although the change is attributed to confusion on the part of the partially color blind.

Gray also must be considered as a color sufficiently distinct from its mixing components black and white to be considered a "primary", or basically individual color.

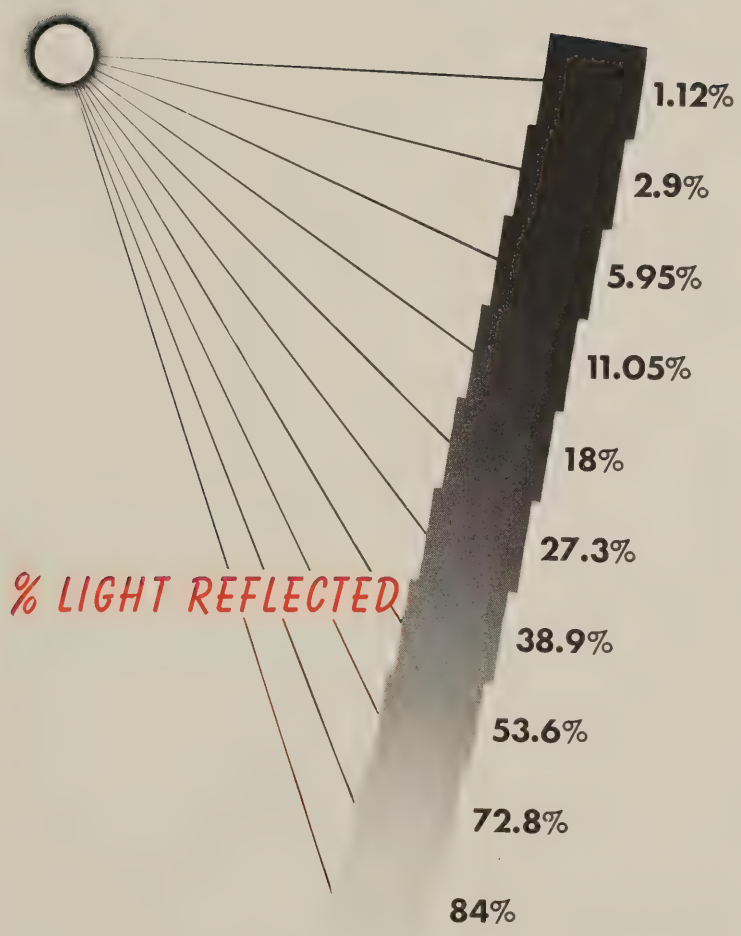
> We have isolated, therefore, the seven unique colors, red, yellow, green, blue, black, white and gray. All secondary colors resemble one of these but *none* of the unique colors resemble each other.

Westinghouse makes a machine that differentiates the hues of the spectrum into 10,000 parts. Its inventor has his own superapparatus for splitting the spectrum into 100,000 hues. That is why it is comforting to know that tests with average human beings prove only 26 pure gradated hues to be readily distinguishable.

COLOR DISTINCTION

Similar tests show the observable gradations from white to black to be nine only (for convenience and conscientiousness most of the color systems use ten). These are important because they show that only in the neighborhood

of 125 colors are distinguishable to the average person. These 125 colors are the 26 hues in their nine value gradations between white and black. The reason we don't have nine times twenty-six is because a pure blue as it is darkened will become indistinguishable from a darkened blue violet. Likewise, a pure yellow when lightened sufficiently will be indistinguishable from an equally lightened greenish yellow. Even more important to us is the fact that although we may deal with 125 observable colors, the color sensations tend to focus around our seven unique colors and the characteristics of the 125 are controlled by their resemblance to any of our basic seven.


% LIGHT REFLECTED
1.12%
2.9%
5.95%
11.05%
18%
27.3%
38.9%
53.6%
72.8%
84%

THE DIMENSIONS OF COLOR

Color terminology is a subject on which the experts disagree and rightfully because there has been too much mumbo-jumbo about it. We believe that the less one goes out of the language of everyday speech, the more understandable one remains. It might be well, however, to be conversant with some of the more generally used terms because laymen have been known to use "hue", "value", and "chroma" when the expert is simply talking about color.

Hue is the quality by which we distinguish one color from another such as a red from a green, from a blue, etc. The property of hue is designated by our common color names.

Any visual sensation is composed of the elements of form and *color*. It follows from this definition that black, white and neutral grays (as distinguished from the form to which they are applied) are also colors. Many writers differentiate between *chromatic* and *achromatic* colors. Black, white and neutral grays are called achromatic colors. Those which fall within the range of the spectrum are called *chromatic* colors and have *Hue* as one of their attributes. *Hue* designates spectrum location without regard for *value* and *intensity*.

Value is the quality by which we distinguish a light color from a dark one. Within any hue family there may be light or dark values — for instance, light green and dark green, or light red and dark red. Light values are considered "high" in value; dark values are considered "low" in value.

The achromatic colors have no attributes other than value which connotes lightness or darkness. But it would not be wrong to speak of an intense black. The ten graded steps between white and black used by modern color systems do not correspond with proportional gradations in their percentages of light reflection. They have been graded by many tests the most usual of which is the color wheel. This has a turntable on which pie-shaped segments of color can be laid and spun at such a speed that they will blend into one color for the eye. It is interesting to note that the accepted "absolute gray" apparently midway between black and white consists of a fifth sector of white leaving four-fifths black uncovered. This mixture obviously would have a light reflectivity of around 20% which shows how little relation there is between the *sensation* of middle gray and the gray which would reflect half of the light rays falling on it. A 50% reflective gray if placed in the sensation scale of ten steps would be very little more than two steps removed from white. Although paints will not mix with the reliable

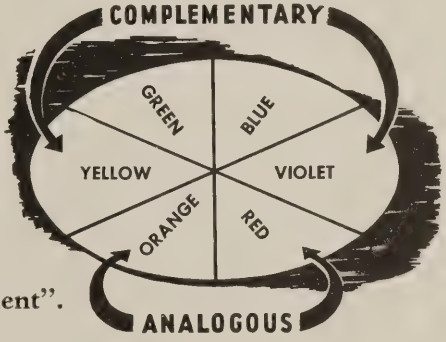
results obtained on a color wheel we get some idea of how far off someone would be if he mixed equal parts of black and white paint hoping to get absolute or middle gray. The *chromatic* colors which have *hue* also have value but the measure of the value is complicated by the fact that the pure hues do not in themselves have identical value. Whereas a pure blue will grade down to black in a few steps, a yellow will take many steps. This is an important factor in the human reaction to hues. The element of darkness is as inherent in blue as the sensation of lightness or sunshine is in yellow. Chromatic colors at their greatest strength (free from the sensations of black or white) may be called pure or saturated colors — or more correctly, *full colors*.

A full color (we refrain from using the word "hue" wherever we can), mixed with white only, is called a *Tint*. A full color mixed with black only is called a *Tone*. Often people refer to a *Tone* as a *Shade* without anyone misunderstanding them although academically, a *Shade* means any variation of a particular color including both *Tones* and *Tints*.

Chroma is the quality by which we distinguish a bright or pure color from one which is grayed. Pure bright colors are considered to have "strong" chroma whereas the grayer they become the "weaker" they are in "chroma".

The more direct of the writers believe that a color can be sufficiently described by naming the color (hue) along with its lightness or darkness. Others bring in the characteristic of *chroma* or *saturation* or *intensity* which means the degree of strength in a color. Thus, a grayish green which is neither darker or lighter than a full green without the sensations of black or white would be said to be lacking in *chroma, saturation* or *intensity* inasmuch as the sensation of the hue itself is slight. We believe it just as adequate to say it is a very grayish green of middle value.

It is important to think in terms of the above "dimensions" of color because the variations in hue and the value relations in a color scheme are fundamental to a "balanced color arrangement".



CHROMATIC CIRCLE

A *Chromatic Circle* is a continuous circle of "saturated chromatic color sensations" where the rate of change in "hue" is constant throughout.

COMPLEMENTARY AND ANALOGOUS COLORS

In a chromatic circle complementary colors are located opposite each other — for instance, red is across from green, blue across

from orange, and yellow across from violet. Colors located close to each other in the chromatic circle are called analogous. Red, orange and yellow are analogous colors. In a broader sense, the colors roughly opposite each other may be termed *contrasting* and the close colors as *harmonious*. These terms are more applicable in describing color schemes because the use of true complementaries together is now considered hackneyed and dull, and the word "analogous" is not well understood by the layman.

AFTER SENSATIONS

The complementary of any color sufficiently intense and well-lighted to build a strong reaction in the eye can be seen by staring at the color and then shifting your glance to a sheet of white paper. The "after" image appearing is the accurate "sensation" complementary. If the original color and its image color were spun on a color wheel, they would blend into a gray.

It is well to remember that a strong color sensation fosters a complementary after image. An environment with an overdose of red in it would tend to make all the white or fairly neutral objects look greenish. In an industry where a worker's color acuity is important, care must be taken to avoid any predominant sensation.

SCIENCE OF COLOR

WARM AND COOL COLORS

As we have already observed, the human reactions to color do not parallel any known scientific phenomena. The sensation of "temperature" in color makes people refer to a hot red or a cold blue but this is not measurable in fahrenheit degrees nor does it proportion in any way to any of the physical characteristics such as millimicron rating or reflective percentage.

In an over-simplified classifying, we can say that the "temperature sensation" of the primaries relates to their spectrum location with red at the hot end, blue at the cold end and green in the middle representing a mean normal temperature that is neither hot nor cold. This rough rule of thumb would hold for evaluating a color scheme of the simplest type where the primaries are used. A red and yellow scheme without any blues with it would certainly be a hot scheme. Not only would it be hot but it would be chromatically unbalanced. The eye would build up a need for greens and blues. White or neutral surfaces seen in this environment would be tinted bluish or greenish by the continual after sensation of these colors; the complementary physical reaction to the ever-present strong reds and yellows.

The paradox of "temperature sensation" is the variation from warm to cool within the broad terms of one color identity. Within the classification of red, for instance, we find a purplish red like "claret" which is comparatively cool in relation to a hot red like Chinese vermilion. Within the blues, we find greenish blues that have a comforting warmth compared with the icy sensation of blues bordering on violet.

This would indicate that when some balance of color is wanted in a warm scheme of reds and yellows a "warm" greenish blue could be added without materially reducing the general warm sensation.

Observing that the sensations are both elusive and paradoxical, we may well wonder what the overall effect of the combination of cool reds with warm blues would be. It would be balanced in color and neutralized in temperature — not as cool as cool reds with cool blues.

TEMPERATURE PROBLEMS AND EXAMPLES

In a plant where work is performed at high temperatures, it would be advisable to offset the heat psychologically with a cool color scheme.

Use blues or cool grays with minor accents of reds and/or yellows, but not if the reds and yellows [redacted] already exist in the sources of heat in the plant — such as ovens and red hot metals or glass. Where no such flame colors

exist and particularly where the atmosphere is humid as well as hot, it is advisable to introduce some elements (such as dado striping, trim, safety colors, pipe identification, etc.) of reds and yellows to offset the deep misty quality which accompanies the combination of moist air and blue or grayish surroundings.

Work at subnormal temperatures can be aided by the converse of providing a warm color scheme.

Here tans and browns can be used to advantage for general background color with reds and yellows in abundant accents. (Too great areas of red never can be used effectively for fear of physicial overstimulation which has been known to cause headaches and irritability.)

COLOR ILLUSIONS

What are the illusions produced by colors? Is not the fact that red looks "hot" although its physical temperature is of no measurable difference from any other color an illusion?

It may be an illusion, or an appearance phenomenon, or an associational sensation. We do not want to concern ourselves unduly with the fine points of terminology. We want only to grasp some knowledge of human reaction when exposed to color. A surface appears light or dark, hot or cold, near or far. The color illusions which we

refer to are those which may make surfaces appear lighter or darker, hotter or colder, nearer or farther. In color planning most of the illusions are by simple contrast. A middle gray chip will look dark gray against white and the same middle gray will look light gray against black. The change in value appearance due to contrast is so great that only a very few specialists with long experience could pick identical color chips from a large assortment lying on a white ground on one hand and on a black ground on the other.

A pure middle gray similarly would appear cold and bluish lying on a hot orange background whereas it would appear warm and tannish on a cold violet-blue ground.

PROJECTION AND RECESSION OF COLORS

If we closely observe the foregoing example of a pure middle gray chip on a hot orange background, we will see in addition to its apppearing cold and bluish the suggestion that it is depressed below the plane of the orange surface because

reds and yellows have a tendency to project themselves forward.

In the case of the gray chip on dark violet blue, the chip will appear to have thickness and be raised above the plane of the blue surface.

Blues and violets have a tendency to recede.

To make background objects bluish to give the illusion of distance is a classic device of painters. In a house with nine-foot ceilings, a hall ceiling was painted a clear deep blue adjacent to a room with a white ceiling. A number of people were asked to guess how much higher the blue hall ceiling was than the white. The answers varied from four to fourteen inches higher although both ceilings lay in exactly the same plane.

We note that everyone was affected by the recessive characteristic of the blue but that the amount of effectiveness varied considerably. The literal and logical person wants a measurement of blue's recession compared to white and compared to red — 5%, 10%? Research in this field is progressing but such figures cannot be relied upon until thousands of tests under hundreds of variable conditions have been collated — even then the figures will be averages from which the individuals reactions may widely vary. At this writing in the field of color reactions, we must resign ourselves to dealing with nothing more accurate than tendencies and generalities. We can, however, be sure of an effect even if we cannot measure the effectiveness. Careful observation of your own color experience will give you some ability to *sense* the measure of effectiveness.

Dark tones of colors recede in relation to tints of colors.

IRRADIATION

This is the term for the tendency of a bright color area to appear larger than the same area in a dull color. This is a characteristic that is noted especially in the example of a black square on white looking smaller than an equal white square on black.

SOLIDIFICATION AND DISPERSION BY COLOR

If we take a complicated form — such as a machine, or a room containing many objects and fittings — and color it in warm colors, reds and yellows, their tendencies of projection and of enlargement through irradiation will give a heightened appearance of solidity and three dimensionality. If the same group of forms are colored in a blue range, the tendencies to shrink and to recede will give an appearance of greater dispersion among the parts and an increased intangibility of the whole.

Neither of the above examples in itself suggests an immediate practical application. A worker would not be aided in his visual task either by having his environment crowd in on him with overpowering solidity or by having it tend to fade away in its entirety. However, by a combination of the two principles, some of the most successful working conditions can be planned by putting the emphasis on significant parts involving the worker and subordinating elements that might confuse or distract him.

The illusion of solidification or dispersion can be achieved by the background alone. Against blues, an object will appear heavy and three-dimensional. Against yellow, it will flatten but appear fine and precise. Experiments in these illusions have been conducted by presenting observers with eight identical black and white photographs mounted on eight different colored backgrounds and asking him to select for precise focus, black and white contrast, definition of printing, etc. This experiment is worth trying if only to see how sensitive to illusions anything can be when submitted to color background changes.

INDUCTION

Along the line where a light and a dark shade of the same color meet, the darker one appears still darker and the lighter one still lighter thus giving the impression of the color areas being shaded.

When contrasting colors meet, this effect is heightened by an increase of hue intensity. Thus a red would look redder and a green still greener along the line of demarcation.

VISIBILITY

APPARENT HEIGHTENING OF ILLUMINATION

You cannot see unless there is light, but when you see, you see color. The nature of the color you see is your only clue to the quantity and quality of the illumination. It stands to reason, therefore, that illumination and color planning are so inter-dependent that the color planning in itself can modify the sense of illumination for better or for worse. Later, in the discussion of illumination, we will deal with the factors of reflectivity as these factors can have a measurable reality in relation to foot candles of illumination. Now we are still concerned with subjective impressions as they may affect the sense of illumination and the sense of visibility.

Perhaps the strongest factor in giving the illusion of brightness is the human association with yellow.

This association is deeply grounded on phenomena in the physiology of the eye. In an abundance of light, our vision finds the red-yellow end of the spectrum exaggerated while in relatively subdued light the blue end of

the spectrum comes forward and the reds and yellows lose color. It is because of this fact that everyone considers sunlight warm and yellowish compared to the cool bluishness of the moonlit world. Physically, there is no difference between the direct white light of the sun and the light reflected from the sun by the moon. It all happens in the eye. Therefore, the eye cannot help but believe the illumination from a yellow light source or reflected from a yellow wall is stronger and brighter than an equal wattage from a bluish light source or equally reflected from a bluish wall.

TWO COLOR RELATIONSHIP

The structure of every color scheme is in the planning of each color in relation to each other color. Indefinite or casual relationship may not only destroy the general harmony but destroy the articulation and clarity. Where there are good contrasts, the sense of visibility and illumination is increased: [redacted] well-complemented hues and a good contrast of values cannot be clearly seen under inadequate lighting conditions.

Another important possibility in the juxtaposition of two colors is the opportunity of bringing out the desired characteristics of the dominant one by its neighbor.

If a warm red is desired, its warmth can be brought out by contrasting it with an accent of cold blue. If a restful vista green is desired, its serenity can be accentuated by small areas of orange vermilion or bright yellow.

CLARITY AND LEGIBILITY

Often it is necessary to select two colors with consideration of their carrying power — a shape which should read well on its background for a distance or an element of a machine which must stand out distinctly. Or the problem may be simply that of giving lettering its maximum legibility. In these cases the problem rests on the same basis and we can have no better guide than results which have been compiled after exhaustive tests. We list below a table of combinations in the order of visibility and legibility of applied color on background color.

1. Black on yellow
2. Green on white
3. Red on white
4. Blue on white
5. White on blue
6. Black on white
7. Yellow on black
8. White on red
9. White on green
10. White on black
11. Red on yellow
12. Green on red
13. Red on green
14. Blue on red.

What can we learn about two-color combinations from the above table? Why is black on yellow in first place and black on white as far down as sixth place? Why are the colors on white more legible than white on color? Why are the colors on color in their complementary and greatest contrasts the poorest of all? The order is factual. We can only deduce the reasons. The experiments were conducted with letters, numerals, and symbols varying from the size of the average auto license plates to the size of the average highway markers.

THIS MORE LEGIBLE THAN **THIS**

We can observe by experiment with type in letters and numerals that the slender figures have greater clarity and legibility than the heavy ones (this is due to the increased ratio of the delineation to the mass in the slender forms).

SOCONY PAINT PRODUCTS

SOCONY PAINT PRODUCTS

If, therefore, equal forms are placed on two different backgrounds, the one which tends to appear more slender by irradiation (the dark color on the bright ground) will be the more legible.

This accounts for the colors on white but not for their respective positions. This order is a matter of focus. To read, the eye must observe both the applied figure and the background. To read well, the eye demands that figure and ground be in the same plane. Apparent discrepancies in the distance of the two colors from the eye, strong variations in values within the two colors due to induction, or glare vibrations at the edges upset the sensation of focus without which the eye is handicapped.

Thus black on yellow is first because the edge is less dazzling than black on white, because the yellow is a more tangible background than white and because the yellow gives a sense of heightened illumination. Unfortunately, the only other experiment on a yellow ground was red which is a combination lacking in hue contrast, value contrast or temperature contrast.

Green on white takes second place because green neither projects or recedes thereby aiding focus.

Red on white comes next and ahead of blue because, though it disturbs focus by projection, this handicap is less when the object is apparently nearer than when, in the case of receding blue, the object is relatively farther away.

The colors on color disturb focus not only by the increased extremes of projection and recession but also by the shimmery variation that is caused in the more extreme cases of induction. In a strong contrast of bright

red on intense green or blue, the forms actually appear pulsating and wavy, due to the activity of the violent after image of the red which forms and moves on to the background like off-register printing to fade and reverse making a continuous animated blur.

We have gone into this at such length because clarity and visibility in a plant and on machines is of such importance that no color scheme must be allowed to conflict with them. Violent contrasts of either values or colors must be avoided.

ASSOCIATIONAL REACTIONS

We might say that a color is known by the company it keeps for this is the basis of association.

Experiments with hundreds of observers have shown that associations to the psychological primaries run fairly uniform.

An observer is told that on exposure to an area of color he is to write down the first thing that comes to his mind. Hundreds of such reactions all fall into three categories — the subjective mood expression, the symbol, or the idiosyncrasy.

For instance, yellow is exposed; the observer writes "merry", "lively", "intense", "bright" and reveals the mood of his reactions. Or, he writes "sun", "gold", "dandelion" and reveals a symbol of the mood of his

reactions. Or, he writes "Mabel" or something that seems to be a personal idiosyncrasy as a reaction. If this can be investigated, we will find that Mabel has golden hair and is bright and lively or if Mabel be a brunette that she wore a yellow dress to the beach on a particularly happy occasion for this observer.

The point is that even the apparently remote reactions can be traced to stem from the average mood response. In conducting such experiments in groups, it has been interesting to see the amazement of the observers when they discover how lacking in individuality their reactions have been.

THE PSYCHOLOGICAL ATTRIBUTES OF OUR SEVEN BASIC COLORS

Red is the most exciting as well as inciting color. It is provocative and has a rich aggressive quality when not overused. In quantity, it is psychologically harmful. Workers affected by the ruby lamps formerly used in photographic processing were discovered suffering extreme migraine from its effect and in some cases it engendered acts of physical violence.

Nature uses it sparingly and for her richest and more flamboyant effects — *flowers, fruit and sunsets.* Red is heady stuff.

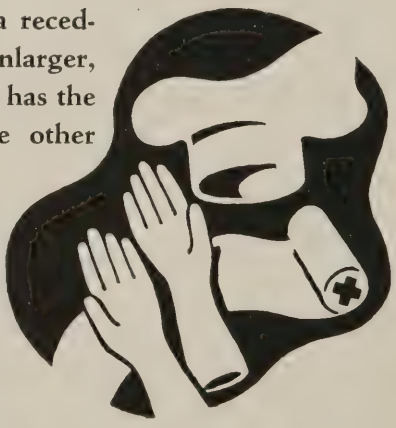
Yellow is exciting but in a merrier, less physical way than red. Too much, or the cooler varieties have a nervous restless effect. On the orange side, the effect has been considered too ingratiating. People take to orange too easily and tire of it as quickly. But in its purer forms *it is the essence of light* — pure sunshine. Lightening it to its extreme tints does not deteriorate its qualities. In this sense it has no pastel shade, does not lose virility as does red diluted to pink—lose depth as does blue washed out to baby blue. No color is better suited for surfaces demanding high reflectivity—no color is more flattering to light.

Green is normalcy in the spectrum. A Russian painter - philosopher said that green is the color of the bourgeoisie. As they are the backbone of the nation, so green is the backbone of the spectrum. It is the good, steady, restful but not sedative color. *It is nature's abundant background.* We cannot have too much of it so long as there are accents of other colors. But green, and blue as well, must be avoided as strong reflective surfaces.

When they discolor light they weaken it. When greenish or bluish reflective light falls on people, it makes them

ghastly. Green is the most refreshing background and a reassuring one for it neither projects or recedes. Green stands pat in a nice way.

Blue is to a certain extent, the color that isn't there. In its lighter versions it is *airy, transparent and evasive*. In deeper tones, it has the mystic depth of shadow. It suggests the bottomless pool. Warm light blues, such as turquoise, have the freshness of green without its substance. Purer blues are restful to the point of sobriety. Too much blue is subduing and can act as a depressant to the extent that people in a blue atmosphere become inert and disconsolate. It is not without reason that we speak of the "Blues" as a mood. As a receding background as a special enlarger, it is unequaled. With green it has the great value of offsetting the other colors to their best advantage. Blue in quantity is no more fearful than the sky provided there are some pleasant colors on the scene.



White has been so often

classed with black and with gray as the absence of color that many people may still quarrel with the inclusion of them in this group of basic unique colors.

The associational reactions, however, to these colors without hue are every bit as strong and if anything more positive and definite than reactions to the hues. If you visualize a person dressed entirely in white or a room with all of its surfaces and objects in gray you get an extreme impression. The associations with white carry a sense of *cleanliness and purity,* sometimes a sense of sanitation to the point of antisepsis. Quantities of white are traditionally used where the worker needs to maintain a high degree of cleanliness in his work. Accents of white always bring associations of neatness and freshness to a color plan.

Accents of white also have value in assisting color focus. It has the effect on other colors of giving a standard which aids the observer unconsciously in measuring, that is, knowing what the hues and values in his environment are. For example, a yellow and green scheme without any white may seem pleasing as a combination but be confusing to the eye. How light is the yellow? Very light compared to the green. All right, then how dark is the green? Very dark compared to the yellow? Under brilliant illumination, the contrast would be greater. As the eye fatigued the contrast would lessen. Is it a warm yellow? Even if it were not, it might appear so by simul-

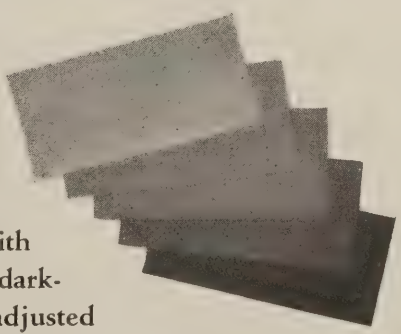
taneous contrast with the green, and in this manner the eyes appraisal never crystallizes.

If pure white touched on these colors, it would give the visual clues to their values and hues. Perhaps such considerations seem finicky and over-precise. They are not because man's most fundamental sense of security rests with just such unconscious relations with his surroundings. Through poor and confused color surroundings, man can be seriously disturbed without ever being aware of the cause. He may say he doesn't like the looks of the place (without knowing why) but more likely he will transfer his uneasiness to some unrelated and often wholly unfounded complaint. We can only be certain that whatever the complaint, it will be some expression of morale and loss of efficiency.

Black (as does white) serves as a comparison standard for the value and hue of other colors. The use of some accents of both white and black in any color plan has the value of giving vitality to the scheme. This because the two comparison standards doubly assist the other colors. By using both black and white, the greatest possible range of value contrast can be brought into the plan. This prevents the color scheme as a

whole from having the unbalance of being too pale and anemic if composed chiefly of tints or of looking too sombre and heavy if the darker tones are used.

The psychological associations with black when it is used in conjunction with other colors are good. Here black connotes strength, emphasis, seriousness. The dominance of black or black by itself is, of course, universally associated with death. The funereal aspect of black, however, is mostly lost in every-day life because the character of the object which bears the color black dominates the association. "Blackness" only slightly conditions the reaction to an object. A black table or a black automobile are in no way depressing and give an air of sleek utility and functional good looks that would not result from an orange table or orange automobile. To understand the acceptability of black and the importance of its role in the environment, we have only to observe what a great number and *variety of the objects in our everyday life are black.*



Gray — Whereas white and black have a strong and contrasting neutrality with other colors, gray can be totally neutral. By tinting a gray, it can be made to harmonize with any hue and by lightening or darkening it gray can be widely adjusted

in its value relation and still remain a gray for all associational purposes. Gray is plain utilitarian, retiring, and can be dull to the point of boredom. Its dullness in color scheme can be a very effective foil to emphasize the character of the chromatic colors and, unlike black and white, it can be adjusted to emphasize illusions. With red, for instance, a greenish gray will lend more brilliant redishness to red than an untinted gray. Or, if desired, a slightly reddish gray can warm the entire scheme and harmonize with red accents so that the accents do not pop out too much.

If a great deal of gray is used, it is essential to blend some color in it or the sense of dull utility can be overwhelming.

Poor grays are the confession of weakness in a timid and unimaginative color planner.

But if the planner is expert, gray is putty in his hands.

TABLE OF TRADITIONAL ASSOCIATIONS AND SYMBOLS

The following is a table of traditional color symbolism and associations as compiled from heraldry, literature and color theory:

Red yellow Yellow	*exciting*	fire—hot—courage—positive— blood-active — passions — tangible — danger — intense — strength — anger — vital — power — piercing — warm — rich luscious — gleaming — joyous— gold — power — distinctive — money — glory — stimulating — merry — nervous
Yellow green	*resting*	spring — gentle — new cheer — delicacy — touchable — fixed fresh
Green		refreshing
Green blue	*quiet*	cool — deep — sedate placid
Blue	*subduing*	sober cold — receding calm
Blue purple		expansive — atmospheric
purple	*pressure*	stern harsh majestic
Red purple		haughty — remote — tragic — precious

RELATION TO SPECIFIC VISUAL TASKS

We have spoken of the reactions to single hues and the effects of certain two color combinations. In considering a color plan, we must remember that the observer's reaction is to the scheme as a whole.

In dealing with color, the whole is not simply the sum of all its parts.

For instance, the reaction to a dominantly red scheme is not necessarily modified by accents of greenish blue. It may be more pleasing to the eye by its variety, more balanced against fatigue, but as we have seen before, the cool accents by contrast would emphasize the warmth and redishness. Thus in color psychology, the whole can be much more than the sum of its parts.

A hue, like a note in music or a word in language, can be defined and have a meaning in itself. In combination with others, however, this meaning may greatly change. This complicates color planning and we must be shrewd to calculate what the general effect of any scheme may be.

One of the chief factors to consider is color quantity.

Large areas of color appear to have greater intensity than small areas. A wall will appear stronger than the paint sample which matches it. The areas may count

strongly in the general design but not in the psychological effect. Here we must consider the overall effect in those broad terms such as hot, cold, stimulating, soothing and the modifications of these.

Aid to precision work is achieved by a conservative color plan without any strong contrasts in the surroundings.

The very nature of the work requires precise evaluations in which there are no great distinctions and the environment can set a sympathetic mood. The scheme should be neutral to cool because this engenders steadiness and seriousness. However, within limitations of value and hue there should be sufficient variety of color to give the eye interest when it rests momentarily from work. Although white is essential to clarity and freshness in the scheme, care should be taken to avoid using it where it might cause a glaring spot or a background that would silhouette an object that should be seen three-dimensionally.

Aid to three-dimensional acuity is chiefly to be desired where shape and distance must be emphasized such as work requiring dexterity with moving machinery.

While silhouetting is to be avoided in precision work, it can be extremely dangerous if it hampers distance judgment in machine operation. Here, obviously, it is good judgment to reasonably contrast objects against back-

grounds to aid illumination in distinguishing planes and forms. The colors should be warm and light because these give tangibility and high visibility.

Yellows against soft grays — pale grays and light tans against vista greens — are the types indicated and the tonic effect of some very light or very dark accents should be added. These keep the eye alert to the entire range of highlights, shades and shadows which define the forms that are being worked with.

Aid to color acuity may be necessary when a worker is required to maintain a high degree of color judgment.

If he is working with color — matching or sorting — the first consideration of the color plan should be to avoid strong colors in locations that might reflect colored light onto his work. The second consideration is to provide him with some color balance and variety in the background to relieve him from his continual color fatiguing. The background should be varied sufficiently so that his eye automatically and unconsciously can rest on an area that will act as a visual antidote for his task.

The color plan can have strong contrasts of light and dark but should be gentle and well-balanced as to warm and cold. It may appear difficult to introduce colors on walls and objects without the danger of coloring the reflected light — but this can be planned to fit the

specific space and type of illumination. Color placed in shadow or shade such as on window walls or below dado heights is generally safe. It may appear easier to make a white or achromatic scheme with grays but while that solves our first consideration of avoiding color distortion, it fails to give the tonic relief which is our second consideration and which is the more important in point of worker morale.

Aid to muscular work should be planned with the temperature problem as a first consideration.

Over-heating or the sense of over-heating may be the major cause of fatigue in heavy manual labor. If, however, a normal temperature for this activity exists, the worker can be stimulated by the hot active colors. More than one color historian has stated that part of the bravery of the English eighteenth century soldier could be attributed to his bright red coat.

If the color plan lacks boldness and verve, so also will the worker.

In any case, strong color and strong contrasts make a sympathetic environment for vitality and effort.

Aid to speed operations suggests yellow immediately.

It is exciting, gives high visibility and the sense of abundant light. The stimuli of the yellows are somewhat less physical than the reds and therefore more encouraging to alert facility as opposed to vigorous action. Brightness of color is chiefly to be desired and intense blues can be very useful in keeping a scheme fresh and in balancing tension. The scheme should not have the warmth for muscular work nor the coolness desired for precision work, but it should have well-balanced live color rather than subdued neutral color if it is to be effectual.

VISUALITE SCHEMES

THE RECOMMENDED VISUALITE SCHEMES

Sovalex Interior Satin Finish Enamels — Floor & Deck Enamels

	CEILING	WALL	STRIPING ACCENTS	DADO	FLOOR	CHARACTER
1	White 31-W-7	Sun Yellow 31-Y-3	Flag Yellow 31-Y-5	Carrier Gray 31-F-24	Earth Brown 18-D-10	Cheerful walls, exciting accent, cool dado and rich floor—high visibility aid to 3-dimensional acuity and speed — general practicality.
2	White 31-W-7	Chamois Buff 31-C-35	Radiance Red 31-R-8	Red Sand 31-R-6	Earth Brown 18-D-10	Warm stimulating scheme — high practicality — aids active monotonous tasks.
3	White 31-W-7	Cool Green 31-G-21	Radiance Red 31-R-8	Sage Green 31-G-23	Maritime Blue Gray 18-F-30	Neutral temperature — fresh bright — aids speed and precision tasks — produces sanitary effect.
4	White 31-W-7	Chamois Buff 31-C-35	Russet Red 31-R-7	Carrier Gray 31-F-24	Maritime Blue Gray 18-F-30	Neutral temperature—serious atmosphere — aids precision work and color acuity.

5	White 31-W-7	Sun Yellow 31-Y-3	Whitehall Green 31-G-24	Sage Green 31-G-23	Medium Green 18-G-1485	Warm, cheerful, high visibility — aids speed operation and eye strain.
6	White 31-W-7	Highlight Gray 31-F-22	Clipper Blue 31-B-15	Chalk Gray 31-F-23	Light Gray 18-F-1004	Cool, restful, strong for precision work and warm temperatures.
7	White 31-W-7	Cool Blue 31-B-14	Whitehall Green 31-G-24	Carrier Gray 31-F-24	Maritime Blue Gray 18-F-30	Similar to "6" but more stimulating and better aid to 3-dimensional seeing.
8	White 31-W-7	Chalk Gray 31-F-23	Russet Red 31-R-7	Carrier Gray 31-F-24	Maritime Blue Gray 18-F-30	Cool and sanitary with normal reflectivity for precision visibility.
9	White 31-W-7	Highlight Gray 31-F-22	Maritime Blue Gray 31-F-25	Sage Green 31-G-23	Blue Gray 18-F-1299	Cool combination of colors make a restful scheme.
10	White 31-W-7	Highlight Green 31-G-22	Russet Red 31-R-7	Sage Green 31-G-23	Earth Brown 18-D-10 or Light Gray 18-F-1004	Neutral atmosphere popular for average tasks.

NECESSITY FOR ADAPTION TO SPECIAL CASES

The foregoing schemes are based on time-tested standards of color harmony and consumer acceptance. They are good design and highly useful. They are generalization, however, as there is probably no one industrial paint problem to which they can be applied without some adaptation and modification.

In one plant, wall installations may prevent a dado — but the dado color can be used on doors, cabinets, low partitions, etc. and the striping color can be used on trim, columns, machine parts, etc. In another plant, sky lighting and overhead machinery may eliminate a painted ceiling. If the ceiling is very high it may be wise to bring the white of the ceiling part way down the walls. This would make a good light reflecting and diffusing area as well as break and reduce the sense of height and monotony.

It is necessary to remain open-minded and not to jump to conclusions until a thorough survey of the working and visual needs in a plant is made.

RECAPITULATION OF BASIC RULES OF THUMB FOR GOOD SCHEMES

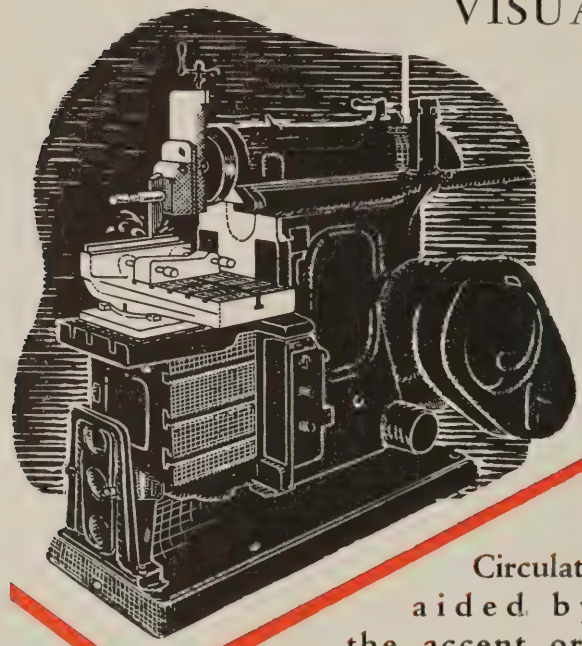
When the plant requirements are known, it may be helpful to select one of the recommended schemes and start with this as a point of departure exaggerating or toning

down its characteristics as indicated and distributing the color according to the logic of the existing conditions.

If none seems completely suitable, you can synthesize your own scheme by assembling the characteristics desired and then trying the colors that provide these characteristics and editing out their alternate to form the most pleasing combination.

For example, if a high visibility, stimulating scheme is required, we know the walls must be very light, warm colors and the accents contrasting, probably bright greens or blues. We know that there must be a good dark value also in combination in floor or dado or both. To sustain the stimuli this should not be too achromatic. Make some trial and error comparisons with related alternate hues and values of the colors you have selected and judge your own reactions. Is A more pleasing than B? Is A more conservative than B? Is A more practical than B? Then ask yourself the same questions in relation to your client because in color, personal taste is always involved. Is the client progressive or conservative in his outlook? Does your scheme relate to the administrative policy as well as to specific working condition requirements?

SPECIAL ADAPTATIONS OF VISUALITE



Circulation can be aided by using the accent or striping colors to guide and confine movement within the plant.

Striping on the floor to define the aisle spaces not only helps to define areas that must be left open but assist the steering of trucks and dollies and thereby prevents damage to walls and machinery. Similarly strong contrast and bright colors around door and elevator openings at bases of free-standing columns make for speedier, more orderly and safe movement.

Machinery is being greatly improved by the modern practice of painting with much lighter and brighter color.

The parts of the machine should be articulated through the use of several colors according to the logic which the machine and its operation present. Moving parts should be one color against a background of another that complements them. Critical elements which demand handling or attention should be still another color, easily identifiable and acting as a constant reminder to the operator. Working surfaces should be colored for best visibility of the work, etc.

Specifics will vary with each machine but a thorough observation of its function will lead immediately to the application of Visualite precepts and a vast improvement of the machine as a productive tool.

Rest and Recreation Rooms take their character by contrast to the working area.

If the plant proper for practical reasons cannot take as balanced color or as interesting values as are usually desired, this can be compensated in the rest rooms and other auxiliary space. As the time spent in these areas is very little compared with that in the working areas, there should be plenty of punch here. Keep them vivid, warm, cheery, sanitary-looking and provide colors that are lacking in the work space.

Institutional colors do not play an important part in

Visualite but as the world becomes more and more color conscious, greater stress will be placed on the extension of color relations between industrial interiors and their adjoining offices, the plant exteriors, even the trucks, cartons and packaging of the product. This is a trend and the astute color planner will think in terms of this interrelation and scheme along these lines if the opportunity arises, even if all he can do is to bring an identical accent color throughout. This sense of institutional identity through color is of intangible value but it promotes pride and good will and at practically no extra cost.

Hazardous industries may depend more upon the effectiveness of the safety code than others and Visualite can increase the code's effectiveness. This can be done by using the safety colors in larger areas and by applying them to special backgrounds for each so that they will "pop out" more than on the general wall color (contrast them in value and complement them in hue such as red on white or pale blue gray, yellow on black or navy blue, etc.)

MAINTENANCE AND VISUALITE

A great deal of maintenance work is done to keep up appearances. Visualite in providing a proper and vital color plan can so improve the appearance of a plant that many maintenance costs can be cut down. Visualite plans light colors where their reflection values will aid the illumination — plans color combinations to aid visibility and hence, avoids additional lighting installation and power costs. Visualite plans strong practical colors on surfaces subject to dirt and traffic film and cuts the costs of repeated repainting. By the use of color contrast in defining the circulation and machinery throughout the plant, savings are made by lessening breakage of machines and scarring of walls.

OPERATION AND VISUALITE

By including the safety code in its color plan and by contrasting critical areas and spotting danger spots, Visualite helps prevent operational accidents to the personnel. In providing a safer operation for the worker great savings are achieved through less waste of materials, less spoilage in the manufactured product and less lost production time.

VISUALITE SAVES SIGHT

Visualite recognizes that of all the machines and tools used in production the eye is the most critical.

The healthy eye needs a balance of light and dark and a balance of color. Brightness is relative and without dark

areas or dark colors within the field of vision for contrast, the eye loses the sense of sufficient illumination. The comprehension of color is also relative. By continued concentration on a single color, the eye accustoms itself and loses the sense of that color unless there are other colors of the spectrum upon which it can momentarily rest thereby refreshing itself.

It is the most sensitive precision instrument and, therefore, requires the most care, maintenance, adjustment and conditioning in industry. Medical research has clearly demonstrated that the effects of eye-strain or fatigue are not confined to the eye alone. They produce a series of harmful reactions in the body—nervousness, abnormal fatigue, internal disorders—resulting in minor physical breakdowns and absenteeism or in substandard conditions causing carelessness, dissatisfaction, even morbidity.

No person can properly perform a visual task under conditions which cause eye-strain. VISUALITE includes the color ingredients from which the necessary prescription can be made for any specific problem.

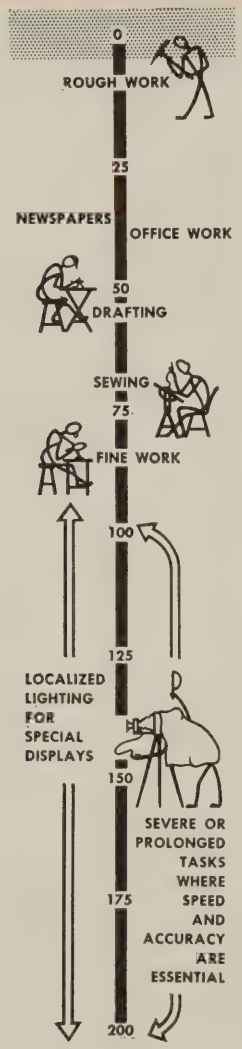
ILLUMINATION

INTRODUCTORY

The relation of lighting to the paint plan is obvious and fundamental. An object is seen solely by the light rays which it gives off either as a light source (the sun, a flame, a white-hot filament, a luminous gas) or as a reflective surface (a cloud, a metal reflector, a ceiling, a machine, etc.) For visual task, there must be enough light. But the obviousness of needing light in quantity must not obscure the fundamental necessity of having the right quality of light. This is where VISUALITE can help. The illumination in almost every case will have been previously designed and installed.

In all probability, the quantity of light is adequate for this is a matter of distributing wattage to produce certain foot candles at the working surfaces.

VISUALITE'S task is to adapt to the existing conditions and assist in heightening clarity and visibility at the points of work. VISUALITE through color can also aid the "atmosphere" at work.



ASSUMPTION AND ANALYSIS OF EXISTING CONDITIONS

Visibility, we have seen, is not only a matter of lightness (glare blurs vision) but of light and shade in their proper relation (if shadows are too contrasting they appear black and details within them are lost). We have also observed that the viewing of a dark object against a too contrasting light ground silhouettes it, virtually throws the entire object into shadow, and causes all its detail to be lost except its outline. Though the outline may be clear, it is so sharp that it cannot be studied without eyestrain.

RECOMMENDED FOOT CANDLES

It follows, therefore, that the surfaces overhead or above the plane of vision can be very bright. In fact, they should be bright because they need to reflect and disperse the illumination. (Lighting engineers use a rule of thumb for glare in light sources. They calculate that glare is safe if one must raise

one's eyes and one's "line of vision" forty-five degrees from the horizontal to see it.)

Lighting engineers and painting engineers have a rule of thumb for the minimum amount of light to be reflected from surfaces in the average industrial plant. This we call the 80-40-20 rates meaning the ceiling should reflect at least 80% of the light received, walls and machinery 40% and floors 20%.

This is a broad rule and much flexibility can occur within it. Often machinery has individual spotlight illumination and special problems. In most cases, the work areas on machines should be "highlighted" with paint of high light reflectivity. Remembering, however, that too great contrasts are a source of fatigue, we must take care that backgrounds are never too light or too dark.

On larger machines it may be advisable to introduce an intermediate value of color between the "highlighted" areas and the general color of the machine's parts and background that should not be seen during the operation.

LIGHTING ATMOSPHERE IN THE COLOR PLAN

(Translation into requirements of color scheme)

Before setting a color plan for an industrial interior, we must see if we can aid the quality of illumination in its most general sense. Does the lighting give an effect of warmth or is it cool and bluish? Does it make for a bright

contrasting interior with objects defined by sharp lights and shadows or is it so distributed that everything seems quite equally illuminated and visibility is obtained by detail and gradual shading? We have all experienced a preference for a clear sunny day over a hazy one regardless of the actual amount of light or near-object visibility. Everyone responds pleasurably to the sight of a red barn or yellow house in a bleak misty landscape.

If the lighting atmosphere is cool and bluish, Visualite can give it a psychological lift by using clear warm colors. If it is monotonously illuminated with diffuse light without the sense of sharp light and shade, Visualite can aid by introducing good contrasting colors and some dark accents.

Every good color planner should get the right "sense" of the interior atmosphere as well as the detailed task requirements. It is important to note that when a plant is daylight illuminated, it may need more corrective color than if artificially illuminated. This need may arise from strong blue casts reflected from the sky through skylights or the upper areas of windows or it may come from the excess of diffusion caused by translucent window glass.

In addition we must consider the bad weather and dreary days to which artificial illumination is not subject. Good color is a remedy for "Blue Mondays".

TERMINOLOGY

Indirect lighting is a condition where all the light is reflected from the ceiling and upper side walls.

This means that the paint of these areas must be white or one of the high reflective tints. It also means that the light quality may be too even and cool requiring a Visualite plan with warmth and contrast.

Semi-indirect lighting is where most of the light is reflected to the ceiling and upper side walls with some of it coming directly from a reflector or diffusing glass down to the working surfaces.

The ceiling and upper walls will have to be high reflective color in proportion to how much of the light utilizes them for reflection. As this light has more vitality than indirect lighting a corrective color plan may not be necessary.

Direct Lighting is where all the light is directly reflected to the work areas.

Here the selection of ceiling and wall color is for visibility and background — we must avoid overcontrast due to their darkness. The sense of dinginess which will occur in the shaded ceiling and wall can be overcome by intensifying their hue content. In shade a color strong in pure hue will look lighter and cleaner than a neutral less chromatic color even though the latter may actually reflect a greater percentage of light.

Daylight can be thought of as a condition where the window glass areas are the lighting fixtures.

Visualite must recognize what direction the light rays take from the glass and what wall surfaces must necessarily be light to reflect light to the working surfaces.

The Foot Candle is a unit of illumination.

It is a standard derived from the amount of illumination on an area one foot away from one standard wax candle. An ordinary twenty-five watt bulb has twenty-five candle power. As illumination diminishes by the square of the distance from the source, the twenty-five watt bulb would deliver as illumination of one foot candle to a surface five feet away.

Reflection is the light which is turned back from an object such as a painted surface.

It is the opposite of absorption. White paint will reflect 89% of the light whereas flat black will reflect as little as 2%.

Specular reflection is light striking a surface and reflecting at an angle equal to its own angle with that surface.

A mirror is a perfect example when it picks up a beam of sunlight and reflects it at any angle the holder of the mirror may make. Surfaces appear shiny due to specular reflection.

Diffuse Reflection scatters the light rays in many cross directions and gives off a soft luminosity.

Surfaces appear semi-gloss or dull and mat according to the extent of diffuse reflection.

SURFACE CONSIDERATIONS

We see from the above that the less glossy the surface, the more diffuse will be the reflection.

Diffusion assures us of the best distribution of reflected light. Whenever surfaces do not need a gloss for protection, the comparatively flat paints should be used.

They also have the advantage of giving the full color effect because the shiny surfaces tend to mirror lights, darks, and other colors which obscure the color effect. Specular reflection causes a glossy object to look very much lighter than it is if the observer is in the field of reflected light or very much darker if he is not. In prac-

tical painting it is well to remember that gloss for this reason also shows up all the irregularities and flaws in a surface.

Floor reflection during the war was found so necessary in working under the wings of airplanes that the floors were painted white. This is a special case but there may be similar ones where the upkeep costs would be more than compensated by the value of upward reflected light. Ordinarily, the floor is painted for dirt concealment but should not be so dark that objects cannot be readily found on it or so dark that visibility for cleaning is lost.

Fluorescent light bleeds out the red side of the spectrum so all color values on the red side must be highly intensified when fluorescent lighting is used.

Incandescent light more nearly approaches daylight as it contains the daylight properties of the spectrum.

RECAPITULATION

This Color Manual has been prepared to provide an understanding of the Visualite Plan. Visualite is *better painting practice* but its effectiveness depends on an understanding of the clients' problems and your ability through your knowledge to acquire the opportunity to do a thorough Visualite job for the client. He will appreciate both the direct and indirect savings that Visualite can achieve. The direct savings as we have seen lie in an

assurance of minimum maintenance cost, safety of operation for the worker and increased production from the plant. The indirect savings lie in the intangibles of better employee relations and, more remotely, better public relations.

The most important single fact, however, is that Visualite promotes the best possible working environment. Color has a profound influence on the psychological and emotional reaction of the individual. Color, properly planned, assures good reactions. These increase the productive power of each individual worker and the total production in any plant can be no better than the sum of the output of each individual within it.

APPENDIX

SAFETY COLORS

RELATION OF COLOR TO SAFETY

Industry throughout the years has developed a general safety color code which is now considered the standard for industry. For industry it is essential that we be consistent in our use of colored signals, and it is necessary to have a plan that is simple, readily understood, easy to remember and which will have as near as possible universal application to all industry so that the same signal color will always mean the same thing in each industrial plant. When used with intelligence and according to plan, color can add much to the value of a safety program.

VISUALITE has been so engineered that in any of its schemes the standard color code for industry may be incorporated without detracting from the color harmony and effectiveness of the general plant scheme.

SIGNIFICANCE OF SAFETY COLORS

In considering briefly the colors used in the safety code, we have an opportunity to see some of the many ways in which the psychological associations of color can be put to useful work in industry.

Red — The color of alarm and its traditional association as "fireman's red" has made it the natural choice for all *fire-fighting equipment.*

Orange — Having a slightly higher attention value than red, has been used for *hazardous parts of machinery* and where danger is indicated as distinct from the red of fire caution. To most people orange is not sufficiently distinct from red to justify this use. *We recommend that yellow, which is a more distinguishable color, be used to signal attention to hazards.*

Yellow — Is particularly adapted to hazards within the plant or on machine parts, because it has such high visibility and because its stimulating effect puts the worker on the alert.

Green — Associated with rest, balm and healing is the logical color for *first-aid* equipment and for marking spots on wall or floor areas where such equipment as first-aid cabinets, stretchers, etc., are located.

Blue — Light and bright enough to arrest attention has the characteristic of giving "serious pause". It is used for marking *moving or starting equipment* and for *protective materials and devices.*

White — Because of its lightness has its chief value for aiding the *definition of objects,* particularly in poorly lighted areas. It is ideal for hand rail markers, edges of steps, receptacles and in places where neatness on the part of the worker is essential to the general safety.

SAFETY COLOR CODE FOR INDUSTRY (as generally adopted)

RED — FIRE PROTECTION

The function of Red is to locate and identify for instant use the equipment and facilities needed for fire fighting purposes. It is used for marking all fire protection equipment, apparatus and facilities and identifying unmistakably their location with suitably marked areas on walls and floors.

Partial list of examples:

Fire protection equipment and apparatus
Fire alarm boxes — pull boxes
Fire blanket boxes
Fire buckets and pails — supports — housing — wall locations
Fire extinguishers — supports — housing — wall locations
Fire hose locations — reels — supports — housing — floor and wall locations
Fire hydrants
Fire pumps
Fire sirens
Post indicator valves for sprinkler systems

Red should be reserved for fire protection only — it has but one function. It should not be used to indicate "Danger" — Yellow, with its better visibility, is much more effective.

YELLOW — CAUTION

Yellow denotes Caution. Industrial areas marked with Yellow give warning of a physical hazard and call for the exercise of Caution.

It is used for marking areas where there is present the physical hazard of stumbling, tripping, striking against or getting caught in between machines.

Yellow has very high visibility and is particularly effective as a warning signal when used in conjunction with Black, either as Yellow and Black stripes or Yellow and Black checkered blocks.

A partial list of examples of "Caution" marking:

Industrial vehicles
Projections and rails — guard rails — top and bottom treads of stairways
Fixtures suspended from ceiling or walls which are likely to be overlooked or which extend into normal working areas.
Exposed and unguarded edges of platforms, pits and wells.
Lower pulley blocks on cranes—traveling conveyors.
Floors, walls and aisles around hazards and obstructions.
Waste containers for explosive or highly combustible materials.
Danger signs.

ORANGE — ATTENTION (Alert)

Orange is a subdivision of the "Yellow" family, and is used to further emphasize the caution signal as applied to certain physical hazards. It should be used as a danger signal calling attention to the condition where the guard is down or temporarily not functioning. On the interiors of areas usually covered with guards, it should be used so that when the guard is removed, the orange signal will call attention to the absence of the customary guard.

A partial list of examples of "Attention Calling" marking:

Inside of covers for switch and fuse boxes
Inside of transmission guards for gears, chains, etc.
Inside of movable hood guards.

GREEN — SAFETY

Green denotes Safety. It is used to identify first aid equipment, dispensaries and other facilities pertaining to workmen's protection and marking their location.

The identification of a safety area may be accomplished by using a green cross on a field of white. A predominance of white background will facilitate visibility.

A partial list of examples:

Location of first aid kits
Location of first aid dispensaries
Location of cabinets for gas masks
Location of cabinets for respirators
Location of cabinets for medical supplies
Location of stretchers
Location of safety deluge showers
Signs — safety instruction signs, safety bulletin boards, exit signs.

BLUE — VIGILANCE (Precaution)

Blue denotes a need for vigilance or precaution. It is applied to equipment and machinery, temporarily out of service, usually for repairs. The Blue signal indicates that before moving or placing in service, the equipment should be cleared to see that the operator will not endanger himself or others.

Since this is used primarily as a signal for a temporary condition, it is advisable to use the signal in the form of a movable sign of appropriate shape and size.

A partial list of examples of "Precaution" marking:

Boilers
Ovens — Dryers — Kilns
Valves
Engines
Electrical Controls

WHITE — TRAFFIC AND SANITATION
(Also Gray and Black)

White is used for marking traffic zones on interior floors of industrial plants. White lines on dark floors make very effective aisle markings. On white or very light floors it may be desirable to use Black as traffic markings. Where a traffic line is adjacent to a hazard it may be desirable to mark with Yellow instead of White because of its greater visibility and for its functional meaning of "Caution".

White is traditionally used to denote Sanitation, therefore, it is used as an aid to good housekeeping practice. Corners which are painted White will promote cleanliness and discourage careless disposal of litter.

A partial list of examples:

Traffic zones
Aisle markings
Areas reserved for storage
Corners
Trash cans
Floor and wall areas adjacent to trash cans.

SCHEME FOR IDENTIFICATION OF PIPING SYSTEM

This scheme is intended to identify by means of colors the main classes into which materials in the piping system belong; fire protection equipment, dangerous materials, safe materials, protective materials and extra valuable materials.

It is applicable to identification of piping systems in industrial plants and power plants, including fittings, valves and pipe coverings, but does not include pipes buried in the ground, electric conduits, supports, brackets or other accessories.

Main classification by color:

SAFE PRODUCTS — GREEN

This represents a majority of the products that are handled through a plant. These products may be defined as presenting no hazard in their handling and no extraordinarily high value so that a workman in approaching a piping system to make repairs will run no undue hazard in breaking into a pipe bearing a safe material, even though that material had not been emptied by previous arrangement.

DANGEROUS MATERIALS — YELLOW

These materials are those which in themselves are hazardous to life or property by virtue of being easily inflammable or productive of poison gases or are in themselves poisonous. They include, of course, materials that are known ordinarily as fire producers and explosives.

PROTECTIVE MATERIALS — BLUE

Under this class are materials which are piped through plants for the express purpose of being available to

prevent or minimize the hazard of the dangerous materials mentioned above. Thus, a plant may have certain special gases which are antidotes for poison fumes, which gases are piped for the express purpose of affording protection in emergencies.

EXTRA VALUABLE MATERIALS — PURPLE

These might be classified as a group of the "Safe Materials" mentioned above, but inasmuch as there are cases where safe materials have a very high value it is desirable to give them a separate major classification.

FIRE PROTECTION EQUIPMENT — RED

This might properly be a division of the "Protective Materials" classification mentioned above, though the hazard of fire and the use of automatic sprinkler systems and other fire fighting equipment having become so universal, it would appear desirable to make it a special major classification.

METHOD OF IDENTIFICATION

Having established five classifications and identified each with a specific color, we establish a method of identification.

The piping system may be painted in its entirety, or colored bands may be painted throughout the length of the system.

The actual contents of a piping system may be identified by a stencilled legend giving the name of the product in full or in abbreviated form. These legends to be placed on the painted pipe or the colored bands.

The bands and legends should be placed at intervals throughout the piping system and special attention given to areas adjacent to valves and fittings to insure ready recognition during operation, repairs and at times of emergency.

TABLE OF LIGHT REFLECTION VALUES

WALL COLORS:

CODE	DESCRIPTION	REFLECTANCE VALUE
31-W-7	White — (Interior Satin Finish Enamel)	89.
31-Y-3	Sun Yellow	82.3
31-C-32	Ivory	74.4
31-B-14	Cool Blue	72.6
31-G-21	Cool Green	68.7
31-C-34	Peach	68.4
31-C-33	Cream	65.
31-G-22	Highlight Green	62.
31-C-35	Chamois Buff	60.2
31-F-23	Chalk Gray	58.7
31-F-22	Highlight Gray	55.5

DADO — SAFETY COLORS:

31-Y-5	Flag Yellow	66.4
31-R-6	Red Sand	47.8
31-F-24	Carrier Gray	40.
31-B-15	Clipper Blue	27.4
31-Y-4	Orange	27.
31-G-23	Sage Green	25.
31-F-25	Maritime Blue Gray	18.4
31-R-8	Radiance Red	13.2
31-G-24	Whitehall Green	12.
31-R-7	Russet Red	11.2

GLOSSARY

A collection of terms applying to buildings which may be used by architects, contractors and maintenance personnel in the discussion or specification of painting interiors.

APRON	A plain or molded finish piece below a window or stool to cover the rough edge of plastering.
ARRIS	The meeting of two surfaces producing an angle.
ASTRAGAL	A small convex molding or bead such as used on the closing edge of double doors or shutters.
BALUSTER	One of a set of small pillars that support a hand rail and form with it a balustrade.
BATTEN	A narrow strip of wood; a cleat, as across parallel boards in a door. (BATTEN DOOR)
BAY	A principal compartment or division, as between piers, columns, beams, etc.
CAPITAL	The upper member of a column, pilaster pier, etc.

CASEMENT	A hinged window sash.
CHAMFER	When an edge or arris is cut off at 45°, in a small degree, it is chamfered; if largely cut, it is a canted corner.
CHORD MEMBERS	In a truss, the upper and lower members.
CLEAR-STORY	The highest story of a building with windows opening above the side roofs.
CORNICE	A horizontal molded projection at the top of a building, or round the walls of a room close to the ceiling.
COURSE	A continued horizontal layer of bricks or stones in buildings. Also applied to tile, slates, shingles, etc.
COVE	A concave molding on a large scale.
DADO	A plain flat, often decorated surface at the base of a wall, as of a room.
ENGAGED COLUMNS	Are those attached to, or built into walls or piers, a portion being concealed.

FASCIA	A flat, broad member in frames, moldings or other parts of buildings, but of small projection.
FILLET	A thin band, strip, engraved line or molding.
JAMB	Side post or lining of a doorway or other opening. The jambs of a window (or other opening) outside the frame are called Reveals.
LINTEL	The horizontal piece which covers the opening of a door or window. Also, any horizontal beam resting on vertical supports.
LOUVER	An opening provided with horizontal slats (louvers) which permit ventilation and exclude vision or rain.
MITER	A molding returned upon itself at right angles.
MULLION, MUNION	The wood or iron division between two windows.

MUNTIN	A small, slender mullion in light framing as a sash bar.
NEWELL POST	A post at the end of a stair or hand rail.
PURLIN	One of several horizontal timbers supporting rafters.
RAFTER	Inclined beam, resting on the purlins, which usually supports the roof sheathing directly.
RISER	The vertical part in a step or stair.
SASH	The framework which holds the glass in a window.
SOFFIT	The lower horizontal face of anything, as the under side of a beam of lintel where its thickness is seen. The underside of a staircase, beam, lintel, archway, or cornice.
STAGING	A scaffolding or temporary platform.
WEB MEMBERS	In a truss, the members which are framed between and join the upper and lower chord.

NOTES

NOTES